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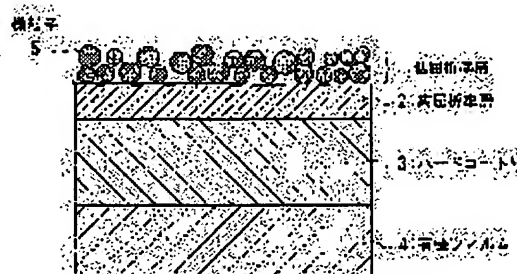
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## (54) ANTIREFLECTION FILM

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a low-cost antireflection films of superior antireflection performance and of mechanical strength and alkali resistance.

SOLUTION: The antireflection film is obtained by stacking a hard coat layer 3, a high-refractive index layer 2 and a low-refractive index layer 1 on the surface of an organic film 4. Each of the layers 1-3 based on a synthetic resin, such as an acrylic resin. The layer 2 is provided with a high-refractive index by incorporating fine metal oxide particles having high-refractive index. The layer 1 is made porous, by incorporating fine particles 5 of a metal oxide or a fluoro-resin in large quantities so as to fully lower the refractive index.



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to an acid-resisting film, and it excels in an acid-resisting property especially, and it relates to an acid-resisting film also with a cheap manufacturing cost.

[0002]

[Description of the Prior Art] In order to prevent reflection of light to PDP (plasma display panel) of OA equipment, or the window frame of a liquid crystal plate, a car, or a special building and to secure high light transmission nature, the acid-resisting film is applied.

[0003] Although it is the coating mold acid-resisting film used conventionally having low acid resistibility ability one layer and two-layer, and making it into four layers or the multilayer beyond it and acid resistibility ability is improved, a configuration becomes complicated and cost also becomes high. Then, as for current, in many cases, three layer membranes are used.

[0004]

[Problem(s) to be Solved by the Invention] The coating mold acid-resisting film by which current marketing is carried out Although the laminating of the rebound ace court layer 3, the high refractive-index layer 2, and the low refractive-index layer 1 is carried out one by one, and they are coated on the organic film 4, among these the low refractive-index layer of the outermost surface consists of a fluoro-resin, a fluororubber and binder resin, silicon resin, etc. like drawing 2 When a fluoro-resin was used, cost quantity and a fluororubber were used and the fall of surface hardness and silicon resin were used, alkali (NaOH) had the fault of being weak. Moreover, by the other matter, it was thought that the reduction in a refractive index was difficult.

[0005] Then, it is required that a low refractive-index layer should be formed cheaply, without using the ingredient of a fluoro-resin system and a silicon system.

[0006] Furthermore, since coexistence with an acid-resisting function and an antistatic function is difficult for the conventional film, a membrane formation technique which has these is desired.

[0007] This invention is made in view of the above-mentioned conventional actual condition, and it aims at excelling in an acid-resisting property and offering an acid-resisting film also with a cheap manufacturing cost.

[0008]

[Means for Solving the Problem] The acid-resisting film of this invention is characterized by consisting of a synthetic-resin system thin film with which it is the acid-resisting film which comes to prepare a rebound ace court layer, a high refractive-index layer, and a low refractive-index layer in the front face of an organic film from a lower layer side, and this low refractive-index layer contained the metallic-oxide particle and/or the fluoro-resin particle.

[0009] The layer which consists of a thin film of this synthetic-resin system is remarkably cheap compared with an inorganic thin film, and easy to form membranes. Although the low refractive-index layer which consists of a thin film of this synthetic-resin system has the inclination for a refractive index to become a little high compared with an inorganic thin film, by considering as porosity, it can make a

refractive index low enough and, thereby, can acquire sufficient acid-resisting property. Especially the voidage of this low refractive-index layer has desirable 10 - 60 volume % more than 10 volume %.

[0010] As this synthetic resin, ultraviolet rays or electron ray hardening type composition resin is suitable, and acrylic resin is suitable especially.

[0011] In this low refractive-index layer, it is desirable to contain especially the particle of metallic oxides, such as ZrO<sub>2</sub>, TiO<sub>2</sub>, NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub>, SiO<sub>2</sub>, SiO, 70 to 99% of the weight 70% of the weight or more for adjustment of a refractive index. When the particle has conductivity like NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub> and ZnO, electrification prevention of an acid-resisting film can be aimed at.

[0012] What is necessary is carrying out coating of the non-hardened synthetic resin (a high refractive-index particle and a conductive particle being included if needed) on an organic film, and making it just make it harden by heating or electron beam irradiation subsequently, in order to form each class.

[0013]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of the acid-resisting film of this invention is explained below at a detail.

[0014] Drawing 1 is the typical sectional view showing the gestalt of operation of the acid-resisting film of this invention.

[0015] Like illustration, the acid-resisting film of this invention on the organic film 4 The rebound ace court layer 3, The laminating of the high refractive-index layer 2 and the low refractive-index layer 1 is carried out. As a formation ingredient of the low refractive-index layer 1 Although the mixture of the particles 5, such as one sort or two sorts or more of metallic oxides, such as ZrO<sub>2</sub>, TiO<sub>2</sub>, NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub>, ZnO, SiO<sub>2</sub>, SiO, and/or a fluororesin, and resin is used for refractive-index control In this case, it has the big description by making the amount of a particle into 70 - 99 % of the weight especially 70% of the weight or more to make the low refractive-index layer 1 into porosity.

[0016] The amount of this particle cannot fully make a low refractive-index layer porosity at less than 70 % of the weight.

[0017] As for especially the voidage of the porosity of this low refractive-index layer 1, it is desirable that it is ten to 60 volume % more than 10 volume %. This voidage has the volume fraction of air too low [ to fully form a low refractive index ] by under 10 volume %.

[0018] Moreover, an antistatic function is given to the acid-resisting film obtained for the conductivity when the above-mentioned particles are NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub> and ZnO. As for the magnitude of these particles, it is desirable that it is 0.1 micrometers or less. When the magnitude of this particle is larger than 0.1 micrometers, the thickness halfbeak of a low refractive-index layer may also become large.

[0019] On the other hand, the mixture of particles, such as ZrO<sub>2</sub>, TiO<sub>2</sub>, NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub>, ZnO, and resin is used for the formation ingredient of the high refractive-index layer 2 for the improvement in a refractive index.

[0020] Under the present circumstances, an antistatic function is given to the acid-resisting film obtained for that conductivity when particles are ITO, ATO, and SbO<sub>2</sub>.

[0021] the case where a conductive particle is used for a low refractive-index layer -- be -- the case where it uses for a high refractive-index layer -- be -- in order to use a particle into a film very much, the inorganic material used compared with the case where an antistatic rebound ace court is used can be lessened, and it leads also to a cost cut.

[0022] In this invention, the bright film of PET, PC, and PMMA is preferably mentioned for polyester, polyethylene terephthalate (PET), polybutylene terephthalate, polymethylmethacrylate (PMMA), an acrylic, a polycarbonate (PC), polystyrene, triacetate, polyvinyl alcohol, a polyvinyl chloride, a polyvinylidene chloride, polyethylene, an ethylene-vinylacetate copolymer, polyurethane, cellophane, etc. as an organic film 4.

[0023] Although the thickness of the organic film 4 is suitably determined by the demand characteristics (for example, reinforcement, filminess) by the application of the acid-resisting film obtained etc., in the usual case, it considers as the range of 1 micrometer - 10mm.

[0024] Each class 1, 2, and 3 is all the things of a synthetic-resin system, and the synthetic resin, especially acrylic resin of an ultraviolet curing mold or an electron ray hardening mold are suitable for it as this synthetic resin. If acrylic resin is used, cost cut, film increase on the strength, chemical-resistant improvement, and improvement in resistance to moist heat can be aimed at.

[0025] As for the refractive index of the high refractive-index layer 2, 1.6 or more are desirable. The refractive index of the high refractive-index layer 2 cannot make a reflection factor small enough less than by 1.6. By making the refractive index of the high refractive-index layer 2 or more into 1.64, the minimum reflection factor of the surface reflection factor of an acid-resisting film can be made less than 1.5%, and the minimum reflection factor of the surface reflection factor of an acid-resisting film can be made less than 1.0% by carrying out to 1.69 or more.

[0026] On the other hand, as for especially the refractive index of the low refractive-index layer 1, 1.35-1.50 are [ 1.50 or less ] desirable. 1.50 super-\*\*\*\*\* and the acid-resisting property of an acid-resisting film worsen [ the refractive index of this low refractive-index layer 1 ].

[0027] The thickness of the rebound ace court layer 3 has desirable 2-20 micrometers, the thickness of the high refractive-index layer 2 has desirable 75-90nm, and, as for the thickness of the low refractive-index layer 1, it is desirable that it is 85-110nm.

[0028] In order to form each class 1-3, it is desirable as aforementioned to carry out coating of the non-hardened synthetic resin (what blended the above-mentioned particle if needed), and to irradiate ultraviolet rays or an electron ray subsequently. In this case, although coating of every one layer of each class 1-3 may be carried out and it may be stiffened, after carrying out coating of the three layers, hardening processing may be carried out collectively.

[0029] As the concrete approach of coating, the coating liquid which solution-ized the acrylic monomer with solvents, such as toluene, is coated by gravure coater, and is dried after that, and the approach of subsequently carrying out a cure by ultraviolet rays or electron beam irradiation is illustrated. If it is this wet coating method, there is an advantage that membranes can be formed uniformly and cheaply at high speed. The effectiveness of improvement in adhesion and the rise of a membranous degree of hardness is done so by irradiating and carrying out the cure of ultraviolet rays or the electron ray after this coating.

[0030] Such an acid-resisting film of this invention can secure good light transmission nature, and a mechanical strength and alkali resistance by applying to the front filter of PDP of OA equipment, or a liquid crystal plate, or the aperture material of a car or a special building.

[0031]

[Effect of the Invention] According to the acid-resisting film of this invention, it excels in an acid-resisting property, and it excels also in a mechanical strength and alkali resistance, and a cheap coating mold acid-resisting film is offered as explained in full detail above. According to this invention, it is possible to make the low refractive-index layer of the outermost layer into the thing of enough a low refractive index. Furthermore, it also becomes possible by using a conductive inorganic material to give the antistatic engine performance and electromagnetic wave shielding ability.

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**CLAIMS**

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[Claim(s)]

[Claim 1] The acid-resisting film characterized by consisting of a synthetic-resin system thin film with which it is the acid-resisting film which comes to prepare a rebound ace court layer, a high refractive-index layer, and a low refractive-index layer in the front face of an organic film from a lower layer side, and this low refractive-index layer contained the metallic-oxide particle and/or the fluororesin particle.

[Claim 2] The acid-resisting film characterized by a metallic oxide being one sort of ZrO<sub>2</sub>, TiO<sub>2</sub>, NbO, ITO, ATO, SbO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and SnO<sub>2</sub>, SiO<sub>2</sub>, SiO and ZnO, or two sorts or more in claim 1.

[Claim 3] It is the acid-resisting film characterized by this synthetic resin being ultraviolet rays or electron ray hardening type composition resin in claim 1 or 2.

[Claim 4] It is the acid-resisting film characterized by this synthetic resin being acrylic resin in claim 3.

[Claim 5] The acid-resisting film characterized by said particle containing 70% of the weight or more in a low refractive-index layer in claim 1 thru/or any 1 term of 4.

[Claim 6] The acid-resisting film characterized by the particle size of said particle being 0.1 micrometers or less in claim 1 thru/or any 1 term of 5.

[Claim 7] The acid-resisting film characterized by this low refractive-index layer being porosity in claim 1 thru/or any 1 term of 6.

[Claim 8] The acid-resisting film characterized by the voidage of this low refractive-index layer being more than 10 volume % in claim 7.

[Claim 9] The acid-resisting film characterized by the refractive index of this low refractive-index layer being 1.50 or less in claim 1 thru/or any 1 term of 8.

[Claim 10] The acid-resisting film characterized by the refractive index of this high refractive-index layer being 1.60 or more in claim 1 thru/or any 1 term of 9.

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